

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of)
Shigeo YOSHII et al.) Attention: Applications Branch
Serial No. 09/895,213)
Filed: July 2, 2001)
For: SEMICONDUCTOR LIGHT-EMITTING)
DEVICE AND APPARATUS FOR)
DRIVING THE SAME)



PRELIMINARY AMENDMENT

Honorable Commissioner for Patents

Washington, D.C. 20231

Sir:

Please preliminary amend the above-identified application as follows:

IN THE SPECIFICATION:

Please amend the specification as follows:

Page 4, Paragraph 1

As an example of driving voltage applied during the light-emitting period, a voltage in a forward direction (forward bias voltage) is applied between the base layer 903 and the emitter layer 905 such that the base layer 903 and the collector layer 902 are set at an equal potential of 0 V.

Page 4, Paragraph 3 continuing on Page 5

During a light-extinct period, a voltage in a reverse direction (reverse bias voltage) is applied between the base layer 903 and the collector layer 902. This depletes substantially the entire region of the base layer 903, as shown in the energy-band diagram of FIG. 19, so that the holes confined to the active layer 904 are extracted to the collector layer 902. If the holes can be extracted from the active layer 904 with sufficiently high efficiency, the concentration of the holes in the active layer 904 is reduced so that the quantity of carriers recombined for light emission is reduced and light emission is suppressed. Since the hole extracted operation is not

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dependent on the speed carrier recombination for light emission, light emission can be halted promptly so that high-speed modulation is allowed.

Page 40, Paragraph 2

In the five embodiment, the impurity concentration in the base layer **504** has been adjusted to the about $1 \times 10^{17} \text{ cm}^{-3}$, while the impurity concentration in each of the collector layer **502** and the emitter layer **505** has been adjusted to $1 \times 10^{18} \text{ cm}^{-3}$.

Page 43, Paragraph 5 continuing on page 44

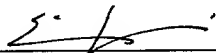
Although the fifth embodiment has used AlGaAs for the emitter layer **505**, if GaInP is used similarly to the collector layer **502**, the effect of confining carriers to the base layer **504** can be enhanced. Conversely, if AlGaAs is used for the collector layer **502**, the undoped semiconductor layer **503** or the graded composition layer can be formed between the base layer **504** and the collector layer **502** in an easier fabrication process.

FOR ETS990

REMARKS

This amendment corrects minor typographical errors in the specification. Examination on the merits is requested.

Respectfully submitted,



Eric J. Robinson
Reg. No. 38,285

NIXON PEABODY LLP
8180 Greensboro Drive
McLean, Virginia 22102
(703) 790-9110

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION:

Page 4, Paragraph 1

As an example of driving voltage applied during the light-emitting period, a voltage in a forward direction (forward bias voltage) is applied between the base layer [904] **903** and the emitter layer 905 such that the base layer [904] **903** and the collector layer **902** are set at an equal potential of 0 V.

Page 4, Paragraph 3 continuing on Page 5

During a light-extinct period, a voltage in a reverse direction (reverse bias voltage) is applied between the base layer **903** and the collector layer **902**. This depletes substantially the entire region of the base layer [904] **903**, as shown in the energy-band diagram of FIG. 19, so that the holes confined to the active layer **904** are extracted to the collector layer **902**. If the holes can be extracted from the active layer **904** with sufficiently high efficiency, the concentration of the holes in the active layer **904** is reduced so that the quantity of carriers recombined for light emission is reduced and light emission is suppressed. Since the hole extracted operation is not dependent on the speed carrier recombination for light emission, light emission can be halted promptly so that high-speed modulation is allowed.

Page 40, Paragraph 2

In the [third] five embodiment, the impurity concentration in the base layer **504** has been adjusted to the about $1 \times 10^{17} \text{ cm}^{-3}$, while the impurity concentration in each of the collector layer **502** and the emitter layer **505** has been adjusted to $1 \times 10^{18} \text{ cm}^{-3}$.

Page 43, Paragraph 5 continuing on page 44

Although the fifth embodiment has used AlGaAs for the emitter layer [502] **505**, if GaInP is used similarly to the collector layer **502**, the effect of confining carriers to the base layer **504** can be enhanced. Conversely, if AlGaAs is used for the collector layer **502**, the undoped semiconductor layer **503** or the graded composition layer can be formed between the base layer **504** and the collector layer **502** in an easier fabrication process.